Pollution prevention for laboratories

Organizations such as MRICD, CHPPM, ARL seeking creative ways to reduce waste, prevent pollution at labs all over APG

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About 55 percent of the hazardous material inventory at Aberdeen Proving Ground supports the research, development, testing and evaluation of military equipment and weapons systems.

Some APG tenant activities that conduct laboratory experiments are making great strides to prevent pollution that would otherwise be emitted, discharged and discarded from their laboratories, according to post pollution prevention personnel. From designing laboratory experiments that eliminate waste to using alternative materials to clean equipment, there are numerous opportunities to increase worker health and safety, save money and reduce pollution at the source.

The Medical Research Institute of Chemical Defense has reduced laboratory waste in several ways.

"Our mission is to protect the soldier through research and testing," said Dawn Valdivia, MRICD's activity environmental coordinator. "Pollution prevention is a priority to MRICD because it increases worker safety, saves money and just makes sense."

MRICD converted most of its photography to digital, eliminating the hazardous chemicals used to develop film since a digital camera records the image on a disk. When possible, MRICD's laboratories now perform chemical analyses by "capillary electrophoresis," which uses electrically charged particles in an applied electrical field, instead of high-pressure liquid chromatography. Capillary electrophoresis uses significantly less organic solvent, so reductions in waste organic solvent can be in the hundreds of pounds per year.

MRICD replaced toxic chemicals with a nontoxic, nonflammable, noncarcinogenic, recyclable, and biodegradable chemical for studying the microscopic structure of certain tissues. The institute automated the chemical analysis of the effects of certain chemicals on cells, resulting in a sizeable decrease in the use of hazardous reagents.

MRICD also purchased new equipment to segregate the hazardous chemicals used in electron microscopy, which is the use of a highly accurate microscope in which the source of illumination is a stream of electrons. This reduced waste generation and disposal costs. MRICD also uses microchemistry techniques whenever possible, reducing the amount of chemicals for experimentation while achieving the same results.

At the U.S. Army Center for Health Promotion and Preventive Medicine, "pollution prevention is a top priority," said Creighton Jacobson, chief of the Safety and Environmental Management Office.

"In addition, P2 is not just the right way to do business - it’s the only way," he said.

CHPPM converted all photography to digital. Due to the exacting nature of robotics, CHPPM replaced a manual extraction system with a robotic extraction system to assist in sample extraction, thereby lowering labor costs, reducing hazardous solvent wastes and improving overall performance.

CHPPM converted some noncritical glassware cleaning from a chromic acid bath method to the use of a safer, biodegradable cleaner. The chromic acid bath, which is used for materials requiring the greatest degree of decontamination, generates a potassium chromate waste stream. By identifying and modifying cleaning activities that do not require this process, the laboratory reduced its generation of potassium chromate waste.

The U.S. Army Research Laboratory also employs five major pollution prevention practices in their laboratory operations.

"Risk management is a priority for us at ARL, so pollution prevention is integral to the success of our operations," said Karen Ferguson, ARL’s activity environmental coordinator.

In fact, ARL takes this so seriously that it operates its own chemical pharmacy, the RK HAZMART, which purchases chemicals in the smallest quantities needed and encourages users to borrow chemicals from others, re-use chemicals when possible and practice first-in, first-out inventory management. RK HAZMART personnel also shop for alternative products, buy bulk chemicals and dispense only what is needed for experiments.

ARL uses microchemistry techniques whenever possible, using minimal quantities of hazardous chemicals. ARL replaced all conventional photographic processes with digital technology. ARL X-ray laboratories reuse fixer by sending it through the photo-processor multiple times, reducing the overall use and disposal of fixer. The laboratory incorporated pollution prevention into the curriculum of its Custom Building 4600 Safety, Health and Environment Training Course, and the Hazardous Waste Handler Initial Training Course.

In addition to the sophisticated success stories mentioned above, simple ways can prevent pollution and hazardous wastes in laboratories. Best management practices can improve worker health and safety, reduce the cost of disposing of expired materials and decrease time spent managing hazardous materials.

Finding ways to

reduce waste

If you work in a laboratory, consider these tips:

• Purchase chemicals in the smallest quantities needed.

• If trying a new procedure, obtain the chemicals needed from another lab or purchase a small amount until it is determined that more of this chemical will be used.

• Implement the first-in, first-out rule for hazardous materials inventory management.

• Evaluate laboratory procedures to see if less hazardous or nonhazardous reagents can be used; scale down experiments that use hazardous chemicals (microchemistry).

• Review the use of highly toxic, reactive, carcinogenic or mutagenic materials to determine if safer alternatives are feasible.

• Purchase equipment that produces less or no waste.

• When preparing a new protocol, consider the kinds and amounts of waste products it might generate and see how they can be reduced or eliminated.

• Whenever possible, use detergent and hot water for cleaning up instead of solvents or other chemicals.

Substitutes available to reduce exposure to hazardous materials include ethanol for formaldehyde in storing biological specimens; lauryl peroxide for benzoyl peroxide when used as a polymer catalyst; and stearic acid for acetamide in phase change and freezing point depression.

For more information on pollution prevention in laboratories, contact your organization’s environmental office or the APG Garrison Directorate of Safety, Health and Environment, Environmental Compliance Division, Pollution Prevention Office, 410-278-7898.

The office does not endorse any particular product or manufacturer.